Bootstrapping and The Bayesian: Why The Conservative is Not Threatened By Weisberg's "Super-Reliable Gas Gauge"

Allison Balin

Abstract: White (2006) argues that the Conservative is not committed to the legitimacy of the bootstrapping procedure. Weisberg (2010) presents a case in which the Conservative apparently is committed to the legitimacy of the bootstrapping procedure. I argue here that Weisberg's case depends essentially upon the rejection of a Bayesian picture of evidence and the related misuse of an otherwise plausible principle. As a result, Weisberg's example does not achieve its purported goal, and the Conservative can avoid bootstrapping by adhering to Bayesian principles of evidence.

1. Introduction

Bootstrapping is a general style of objection that has been raised against a number of different epistemological views. The problem is that some views apparently allow an intuitively illegitimate procedure to provide us with knowledge, justification or evidence of the reliability of certain processes. Because we do not think that this procedure should be able to provide anything of epistemic value, views that permit this procedure to result in epistemic gains seem to be somehow defective. If there is a problem with any view that permits bootstrapping, then it is worth investigating which views permit it and which views do not.

Bootstrapping was initially posed as a problem for reliabilism by Fumerton (1995) and Vogel (2000). Cohen (2002; 2005) extended the scope of the problem and argued that bootstrapping is an objection not only to reliabilism, but also to any other view that permits basic knowledge.[1] Weisberg (2010) extends the problem even further by presenting a case that demonstrates the apparent susceptibility of views that do not permit basic knowledge.

The bootstrapping objection is interesting because it was taken to count very strongly against reliabilism when it was first proposed. As the scope of the objection has expanded, a question has arisen as to whether or not bootstrapping is an objection at

[1] Views that permit basic knowledge allow the subject to obtain certain kinds of knowledge without requiring that the subject know antecedently that the source of that knowledge is reliable.

all. If it problematizes every epistemic view, then that seems to reduce the force of the objection. If there are certain views that are not susceptible to bootstrapping, however, then it seems that we ought to prefer those.

White (2006) takes bootstrapping to count strongly against the epistemic view known as dogmatism, but defends the Conservative[2] from the objection. However, Weisberg's (2010) case allegedly reveals that bootstrapping is a problem even for the Conservative. If this is right, then White's objection to the dogmatist is only as powerful as Weisberg's objection to the Conservative.

My primary purpose in this paper will be to examine the discrepancy between the positions put forth by White (2006) and Weisberg (2010) with respect to the Conservative's susceptibility to bootstrapping. I will ultimately argue that the example Weisberg uses to demonstrate that the Conservative faces the bootstrapping objection derives all of its force from two related features. First, the example is implicitly predicated on a rejection of a Bayesian picture of evidence. Second, the example depends essentially upon a principle, which I will call the EA Principle, that cannot be legitimately used in the case in question. As a result, if the Conservative accepts a Bayesian picture of evidence, then Weisberg's case will be effectively blocked, and the Conservative will remain free of the bootstrapping problem.

In order to situate the reader, I will begin by offering a brief history of the bootstrapping problem. I will then explain why White claims that bootstrapping is a problem for the dogmatist but not for the Conservative. In section 4, I will propose a modification to White's account that I think strengthens his case. In section 5, I will explain Weisberg's "super-reliable gas gauge" case, and why this supposedly reveals that the Conservative really does have a bootstrapping problem. In section 7, I will formalize Weisberg's case, and in sections 10 and 11, I will propose two solutions to the problem of bootstrapping that I think are initially plausible. Although I will eventually

---

[2] I will take the term "Conservative" to mean one who accepts the KR principle for knowledge and the JR principle for justification:
"**KR:** A potential knowledge source K can yield knowledge for S, only if S knows K is reliable" (Cohen, 2002).
JR: A potential source of justified belief J can yield justified beliefs for S, only if S is justified in believing that J is reliable.

reject these solutions on the grounds that they are inconsistent with Bayesianism, I think that it is useful to see the intuitive motivation for them. I will then propose that the Conservative adopt a Bayesian solution, since it provides a principled way to account for the intuitions that motivated the two rejected solutions. Finally, I will examine whether or not this solution is compatible with informal epistemology. I will conclude that it is, and that as a result the Conservative can avoid bootstrapping by adhering to the Bayesian picture of evidence. The result is that Weisberg's case, though intended to demonstrate that the Conservative is susceptible to bootstrapping, is not a case that a Bayesian Conservative would find legitimate.

2. Background

The view that Vogel (2002) targets with the bootstrapping objection is "Neighborhood Reliabilism." This view is roughly that one knows *p* if and only if one has a reliably-formed, true belief that *p.* Vogel discusses Roxanne, who apparently bootstraps to knowledge of the reliability of her gas gauge.

Roxanne
Roxanne has no information as to whether or not her gas gauge is reliable. Unbeknownst to her, it is perfectly reliable. She reads the gas gauge, and it says "x." She comes to believe x. On a reliabilist picture, she *knows* x, because her belief is true and derives from a reliable source, namely the gas gauge. She also knows that the gas gauge *says* "x," because her vision is a reliable process. Because she knows x and knows that the gas gauge says "x," she knows by the Closure Principle for Knowledge that the gas gauge was accurate on this occasion. She repeats this procedure many times on many different occasions. She observes that the gas gauge has been right on each occasion, and reasons inductively to the conclusion that the gas gauge is always accurate. She then makes an explanatory-inductive inference to the reliability of her gas gauge. So, Roxanne now knows that her gas gauge is reliable.

This does not seem right.[3] Roxanne had no information about the reliability of her gas gauge, but *came to know* that it was reliable merely by observing the readings that

[3] Kornblith (2009) gives a plausible defense of reliablism from the bootstrapping objection. This will not become relevant here; I am using the example of Roxanne in the context of tracing the history of the

it gave. This procedure seems far too easy to grant the nontrivial knowledge of reliability that Roxanne apparently gains. It would be unproblematic if Roxanne had acquired knowledge of the reliability of her gas gauge by comparing the measurements of a dipstick to the readings of her gauge. However, she relied only upon the gauge. It seems that if an epistemic view allows this defective procedure to provide knowledge, then there is a problem with that view.

Cohen (2002) cites evidentialist foundationalism as an example of a view that permits basic knowledge, and is therefore susceptible to bootstrapping. On this picture, one can know that a card is blue based only on its appearing blue. One can have this knowledge even if one has no antecedent reason to suppose that an object's appearing blue is a reliable indication that it actually is blue.[4]

Mary
Mary does not have any information about whether or not an object's appearing blue is a reliable indication that it is blue. She looks at a blue card, and it appears blue to her. On an evidentialist foundationalist picture, she now knows that the card is blue. She keeps taking looks at other blue objects, and these appear blue to her as well. So, according to evidentialist foundationalism, she knows that they are blue. She thereby amasses evidence that an object's appearing blue is a reliable indication that it actually is blue.

This seems problematic as well, for similar reasons as discussed above. Acquiring evidence that an object's appearing blue is a reliable indication that it is blue is nontrivial, and yet the procedure in question appears to be irredeemably trivial.

The defective procedure used by both Roxanne and Mary is known as *bootstrapping*. There is no agreed upon precisification of bootstrapping in that the necessary and sufficient conditions have not been specified,[5] but the structure is given by the above cases. The details of bootstrapping vary with the epistemic view in question, but the general idea is that the subject makes a series of inferences that are

---

bootstrapping problem. Cohen (2002) notes that "tracking reliabilism" (as opposed to "neighborhood reliabilism") would provide the right answer, but dismisses the tracking view on independent grounds.

[4] Cohen (2002) p. 317

[5] See Titlebaum (2010), p. 2 and Vogel (2008) p. 528 – 9

apparently legitimate, but ends up with a conclusion that is implausible. Interestingly, it has been difficult to pin down what *exactly* is wrong with bootstrapping. Just as there is no precise definition of what constitutes bootstrapping, there is no clear explication of the specific problem with it. The consensus is that it is intuitively implausible: the apparent epistemic gains that result from the bootstrapping procedure do not align with our pre-theoretical intuitions about what constitutes knowledge and evidence and how these are acquired.

3. White and Pryor

In "The Skeptic and the Dogmatist" (2000), Pryor advances an epistemic view that he refers to as dogmatism. The central claim of dogmatism is that for a certain class of perceptually basic contents, having an experience as of *p* provides defeasible prima facie justification for believing *p*.[6] This justification is immediate, meaning that it does not depend upon any justification or evidence that one has for believing any other propositions.[7] It is also defeasible, meaning that if one finds out that not-*p*, or that one is an epistemically bad situation, then one no longer has justification for believing *p*. Because this justification is immediate, one need not have antecedent reason to believe that one's senses are reliable in order to have it; one need only have an experience as of *p* and lack any defeaters for *p.* So, if one has an experience as of a card being red in the absence of defeaters, then one is prima facie justified in believing that the card is red. Like other views that permit basic knowledge, dogmatism is noteworthy for its avoidance of the skeptical paradox, because one need not know that one's senses are reliable in order to become justified in believing the deliverances of one's senses.

---

[6] Pryor defines perceptually basic contents as those propositions that we seem to perceive to be the case *without* requiring the mediation of any other propositions that we seem to perceive to be true. He gives the example of seeming to see a police officer as something that is *not* perceptually basic, since this seeming to see depends upon certain background beliefs about society. He leaves the question of whether or not perceptually basic contents are restricted to whole objects or facing surfaces, for example, to the cognitive psychologists (Pryor, 538 – 9). I think that the answer to this question is of little consequence to this paper.

[7] As a result, it is an example of a basic-knowledge permitting view.

However, in "Problems for Dogmatism," (2006) Roger White presents a series of objections to dogmatism, one of which is the bootstrapping objection. The worry arises that dogmatism sanctions an intuitively illegitimate process of reasoning that apparently allows us to obtain justification for believing that our senses (color vision, for example) are reliable. The following is an illustration of the dogmatist's bootstrapping problem.

Pat's Color Vision

Pat does not have any reason to suspect that her color vision is reliable, and also does not have any reason to suspect that it is unreliable. In order to figure out which it is, she views a series of colored cards. The first card appears C in color, so according to dogmatism, she is justified in believing that it is C. The second card appears C' to her, so according to dogmatism, she is justified in believing that it is C', and so on for all of the cards that she views. She is also justified, by introspection, in believing that the first card *appeared* C and that the second card *appeared* C', etc. So, by the multiple premise Closure Principle for Justification, she is justified in believing that the first card appeared C and was C, and that the second card appeared C' and was C', etc.[8] So, in each of the card viewings, she is justified in believing that the appearance of the card matched the actual color of the card. She is therefore justified in believing that she judged the color of each card correctly. Because she is justified in believing that she correctly judged the color of each card on many occasions, she can justifiably infer that her color vision is reliable.

Like in the cases of Roxanne (reliabilism) and Mary (evidentialist foundationalism), the procedure described here is intuitively illegitimate. Yet, dogmatism apparently permits this procedure to provide Pat with justification for the reliability of her color vision.

Pryor agrees that bootstrapping is problematic, and that the objection would count strongly against dogmatism. However, he maintains that his view does not actually permit bootstrapping. His explanation of why dogmatism does not allow bootstrapping hinges on a principle that White identifies as "Disconfirmability." Disconfirmability is the thesis that we cannot obtain *confirming* results from a test that we know cannot provide a *disconfirming* result.[9]

---

[8] Some reject multiple premise closure principles because of the preface/lottery paradoxes.

[9] This is a plausible principle. Consider the various conseuquences of rejecting Disconfirmability.

Disconfirmability is an explanation of the illegitimacy of bootstrapping that is independent of dogmatism in particular, but Pryor insists that dogmatism has the same ability to appeal to it as any other epistemic view. Because the bootstrapping procedure can never *disconfirm* the hypothesis that one's color vision is reliable, the dogmatist, according to Pryor, is not committed to the view that one can obtain justification for believing that one's color vision is reliable via bootstrapping. If the problem with bootstrapping is explicable by Disconfirmability, then dogmatism in particular is not at fault.

White notes that Disconfirmability might be a principle that adequately explains the problem with bootstrapping. However, it is not a principle that Pryor can use to defend dogmatism, because the principle is actually inconsistent with dogmatism.

White's reasoning is as follows. The dogmatist is committed to the claim that upon viewing a series of colored cards, the subject is *justified* in believing a Track Record proposition, even if the subject lacks antecedent reason to think that her color vision is reliable.[10] The Track Record proposition is of the form:

> "**Track Record**: This card appears to be C in color, and it is C, this one appears C' and it is C',...,and these are all the cards that I have viewed" (White, 2006).

The dogmatist is committed to the claim that the subject obtains justification for a Track Record proposition because the Track Record proposition is merely the conjunction of a series of propositions that the dogmatist claims the subject is justified in believing. Each component proposition fits the dogmatist tenet that if the subject has an experience as of *p* and lacks any defeaters for *p,* then the subject is prima facie justified in believing *p.*

One-sided inquiry: If we know in advance that it is a metaphysical impossibility for a test to ever disconfirm our hypothesis, then it would seem like "cheating" to count the results of the test as confirming our hypothesis. After all, we would then be able to design experiments that would always provide us with confirmation. This means that the "confirmation" in this case would be entirely independent of whether or not the hypothesis actually obtains. This is obviously undesirable.

Reflection violation: The Principle of Reflection essentially says that if you know that your credence in H will be C at some later time, then it should be C now. If you knew in advance that the experiment would provide a confirming result, then it seems like there was no need to perform the experiment. You should have already updated on the relevant result.

[10] As stated before, she must lack defeaters in order to have this justification.

If the subject has an experience as of a card being C in color, then the subject is justified in believing that the card is C in color. In addition, by introspection, the subject is justified in believing that the card *appears* C in color. So, by the multiple premise Closure Principle for Justification, the subject is justified in believing that the card appears C and is C. For each additional card viewed, the subject will be justified in believing a similar conjunction. Then, by the multiple premise Closure Principle for Justification, the subject is justified in believing the conjunction of each of these conjunctions, which is identical to Track Record. From Track Record follows a No Errors claim:

> "**No Errors**: My color-experiences have matched the actual color of each of the many cards that I have viewed" (White, 2006).

This claim follows deductively from Track Record. What it means for a color experience to match the actual color of a viewed card is simply that the card appeared C and was C. If the dogmatist accepts the single premise Closure Principle for Justification, then she is committed to the view that the subject is justified in believing No Errors, since No Errors is entailed by Track Record.[11] From No Errors, the subject can make what White calls an "explanatory-inductive inference" to the reliability of her color vision.

> "**Reliability**: My color-vision is reliable" (White, 2006).

It would be extremely unlikely for unreliable color vision to accurately judge the color of every single viewed card. It seems plausible that perfect accuracy, even in some finite number of trials, is an indication of reliability.

What about Pryor's appeal to Disconfirmability? Pryor claims that with the aid of Disconfirmability, the dogmatist can avoid being committed to the result that the subject becomes justified in believing that her color vision is reliable. According to Pryor, this is because of the fact that the bootstrapping procedure could not have possibly been

[11] It would be implausible for Pryor to give up single premise closure to save his view.

disconfirming of No Errors, and therefore could not have been disconfirming of Reliability.[12] As a result, it cannot be confirming of No Errors or Reliability either.[13]

White claims that this explanation is not available to Pryor. As illustrated above, the dogmatist claims that the color experiences justify the subject in believing Track Record, from which No Errors follows deductively. The dogmatist is therefore committed to the claim that the color experiences confirm No Errors. But, according to the Disconfirmability principle, the color experiences *cannot* confirm No Errors. As a result, Disconfirmability is inconsistent with dogmatism.

It is important to note that Disconfirmability would block confirmation for No Errors, but leave confirmation for Track Record unaffected. This is the case because although the bootstrapping procedure cannot disconfirm No Errors, a color experience *can* disconfirm a particular Track Record proposition. Consider the short Track Record proposition, "card 1 appears blue and is blue, card 2 appears green and is green, card 3 appears gray and is gray, and card 4 appears red and is red." If the first card appears yellow, for example, then this particular Track Record proposition will be disconfirmed.

White addresses the question of whether or not the Conservative is also susceptible to bootstrapping. At first it might seem obvious that the Conservative does not face the objection, because the Conservative does not accept that having an experience as of *p* provides one with immediate prima facie justification for believing *p*. On the Conservative picture, one must possess antecedent justification for believing that one's color vision is reliable in order for a color experience to justify one in believing that a card is C in color. If one already has justification for believing that one's color vision is reliable, then one cannot *acquire* this justification by bootstrapping.

In order to motivate the thought that the Conservative faces a bootstrapping problem, consider the following line of reasoning. It seems that even the Conservative should accept that a subject who does not possess *justification* for believing that her color vision is reliable ought to think that a card appearing C in color is *some* reason to

[12] Since Reliability is inferred from No Errors.

[13] If it is not confirming of No Errors, then an explanatory-inductive inference to Reliability is unwarranted.

think that it is C.[14] In turn, this means that the Conservative must think that the color experiences provide some evidence for a Track Record proposition. This supposedly commits the Conservative to the claim that the subject acquires some reason to think that her color vision is reliable.[15]

White claims that this case does not show that the Conservative has a bootstrapping problem. There are two crucial differences between the dogmatist and the Conservative. The first is that the dogmatist must accept that the color experiences fully *justify* the subject's belief in Track Record, while the Conservative has no such commitment; she can maintain that the color experiences merely constitute *some evidence* for Track Record. The second difference is that the dogmatist is committed the claim that the color experiences provide evidence for No Errors, while the Conservative is not. The dogmatist is committed to the claim that No Errors is confirmed by the bootstrapping procedure because No Errors follows deductively from Track Record, and the dogmatist must accept that the subject is justified in believing Track Record. She must therefore accept that the subject is justified in believing No Errors by the single premise Closure Principle for Justification. On the other hand, the Conservative merely recognizes that the subject has *some evidence* for Track Record, but is not necessarily justified in believing it. And, as White notes, it is incorrect to suppose that if some evidence *E* confirms a proposition *p*, and *p* entails *q*, that *E* automatically confirms *q*. Even though Track Record entails No Errors, and the Conservative accepts that the color experiences provide some evidence for Track Record, the Conservative is not committed to the claim that the color experiences provide any evidence at all for No Errors. The dogmatist must use Reliability to explain No Errors, whereas the Conservative does not become justified in believing No Errors in this way, and so can

[14] Although the subject does not have justification, the subject would still need to have some evidence that her color vision is reliable in order for this example to work. The idea here is that the evidence is not good enough to constitute justification.

[15] It is true that bootstrapping cannot take one from being unjustified to being justified in believing Reliability, but the thought underpinning this position is that bootstrapping cannot provide anything of epistemic value, including any evidence at all for Reliability.

avoid making an inference to Reliability. This is what prevents the Conservative from facing the problem of bootstrapping.

It is important to note that whether or not the subject gets evidence for No Errors is the crucial point of difference between the Conservative and the dogmatist. White's thought is that if one gets confirmation for No Errors, then one cannot avoid making an explanatory-inductive inference to Reliability. This is not the case for Track Record: evidence for Track Record is not necessarily evidence for Reliability. There are many ways to confirm Track Record that do not provide evidence for No Errors, and thus do not provide evidence for Reliability. For example, one could have gotten evidence for some Track Record proposition by learning that the third card will appear blue in color, but this does not correlate at all with the reliability of one's color vision. Whether or not one's color vision is reliable does not increase or decrease the probability that any given card will *appear* blue. After all, the card may *falsely* appear blue. And yet, learning that the card will appear blue is some evidence for a particular Track Record proposition.[16] Similarly, learning that a given card, say the fifth card, *is* blue in color is also some evidence for a particular Track Record proposition, but it is no evidence that one's color vision is reliable. One may not even be able to perceive the color blue. So, we can understand White's position on the matter in the following way:

> **White's Principle**: Evidence for Track Record is evidence for Reliability when it is also evidence for No Errors.

White's claim is that the color experiences, while evidence for Track Record, are no evidence at all for No Errors. In denying that the color experiences constitute evidence for No Errors, White seems to be relying on the Bayesian apparatus. The reason that the Conservative can claim that the color experiences provide no evidence for No Errors (though they provide evidence for Track Record) is that the prior probability that the subject will have any given color experience is the same as the

[16] It is evidence for infinitely many Track Record propositions, but this is not relevant.

probability that the subject will have any given color experience conditional on No Errors.[17]

4. Low Errors

Though the Conservative accepts that color experiences can provide evidence for Track Record, she is free to deny that the color experiences provide any evidence for No Errors. She is therefore able to avoid the result that the color experiences provide evidence for Reliability, which saves the Conservative from the unsavory consequences that face the dogmatist. It is important to note that on this formulation of White's Principle, there may be other ways that the bootstrapping procedure could provide evidence for Reliability. White is claiming that getting evidence for No Errors is one such way, and that the Conservative has the resources to resist it. Getting evidence for No Errors is sufficient for getting evidence for Reliability, but it has not yet been shown to be necessary. If there are ways to get evidence for Reliability without getting evidence for No Errors, then it seems that White's defense of the Conservative could fail to account for these new cases, leaving the Conservative susceptible to bootstrapping after all. I will describe one such case below, and then propose that White can actually strengthen his view to account for it. The result is a fuller characterization of the case, and a demonstration that another potential avenue to bootstrapping is closed off for the Conservative.

Pat's Imperfect Color Vision

Pat is unsure about whether or not her color vision is reliable. She goes to a color vision specialist who shows her a series of colored cards and notes in each case whether or not Pat was right. Pat learns that strictly speaking, No Errors is false. That is, she learns that her color experiences did not match the actual colors of the cards on every single occasion. She then learns that, despite No Errors being false, she still correctly determined the card colors 99 percent of the time. Perhaps she has trouble

[17] $P(H \mid E) > P(H)$ if and only if $P(E \mid H) > P(E)$
$P(C \mid \text{No Errors}) = P(C)$ so,
$P(\text{No Errors} \mid C) = P(\text{No Errors})$

distinguishing a few shades of blue and gray, but was perfectly accurate the remainder of the time.

It seems as though this is some reason for Pat to think that her color vision is reliable. We can even make the accuracy percentage as arbitrarily close to 100 percent as you like; as long as it is below 100 percent, No Errors will be false. But, it is very plausible that Pat should still be able to raise her confidence in the reliability of her color vision knowing that she made errors, but only a low number of errors. In order to account for this fact, I will introduce three new types of claims:

> **Low-or-No-Errors**: My color-experiences have matched the actual color of some high percentage (and possibly all) of the many cards that I have viewed.
>
> **Low-but-not-No-Errors**: My color-experiences have matched the actual color of some high percentage (but not all) of the many cards that I have viewed.
>
> **Low Errors**: Low-or-No-Errors *or* Low-but-not-No-Errors.

A reformulation of White's Principle will also be useful, since it encompasses both No Errors and Low Errors:

> **White's Stronger Principle**: Evidence for Track Record is evidence for Reliability when it is also evidence for Low Errors.

All of the cases of No Errors are also clearly cases of Low-or-No-Errors, since the former entails the latter. As a result, evidence for No Errors will also be evidence for Low-or-No-Errors. The tricky part arises when we consider the cases that are instances of Low-but-not-No-Errors.

Because it is overwhelmingly plausible that evidence for Low Errors is evidence for Reliability, we must consider whether or not bootstrapping can confirm Low Errors. If it can, then it seems like the Conservative is susceptible to the bootstrapping objection. Let's first examine whether or not the Disconfirmability principle can account for Low Errors.

Low-or-No Errors: The bootstrapping procedure could not have disconfirmed this, and so (by Disconfirmability) cannot confirm it either. Therefore this case can be accounted for by Disconfirmability.

Low-but-not-No-Errors: The bootstrapping procedure *can* disconfirm Low-but-not-No Errors, because becoming justified in believing No Errors would amount to disconfirming it. Bootstrapping always gives the result that No Errors obtains, and so always provides a disconfirmation of Low-but-not-No-Errors. We therefore cannot appeal to Disconfirmability to block confirmation of this case.

However, we can employ the Bayesian apparatus to satisfactorily account for all of the cases.

H: Some hypothesis
E: Some evidence
C: Card appears C in color

$P(H \mid E) > P(H)$ if and only if $P(E \mid H) > P(E)$

$P(C \mid \text{Low Errors}) = P(C)$ so,
$P(\text{Low Errors} \mid C) = P(\text{Low Errors})$

$P(\text{Low-or-No-Errors} \mid C) = P(\text{Low-or-No-Errors})$ so,
$P(C \mid \text{Low-or-No-Errors}) = P(C)$

$P(C \mid \text{Low-but-not-No-Errors}) = P(C)$ so,
$P(\text{Low-but-not-No-Errors} \mid C) = P(\text{Low-but-not-No-Errors})$

As demonstrated by the Bayesian reasoning above, the color experiences cannot confirm Low Errors. In fact, the color experiences cannot confirm any hypothesis about reliability, because no hypothesis about reliability has any effect on the probability that any given card will appear C. As a result, finding out that a given card appears C cannot be reason to update one's credence that any given hypothesis about reliability obtains. So, the Conservative is still able to avoid the problem of bootstrapping with this broadened account.

5. Weisberg's Super-Reliable Gas Gauge:

Vogel (2000) argues that reliabilism is susceptible to the bootstrapping objection. Cohen (2002; 2005) expands on this and claims that in fact, any view that denies KR has a bootstrapping problem:

> "**KR**: A potential knowledge source K can yield knowledge for S, only if S knows K is reliable" (Cohen, 2002).

Weisberg (2010) advances the view that the bootstrapping objection is an even more general problem than Cohen (2002; 2005) suggests. He claims that it is a problem even for those views that *accept* KR. This is in conflict with White's (2006) defense of the Conservative. If Weisberg is right, then White's explanation of why the Conservative avoids the problem of bootstrapping must be flawed.

Weisberg presents a case that challenges the position that an epistemic view cannot be susceptible to the bootstrapping objection as long as the view requires that the subject have antecedent knowledge of the reliability of a source before having knowledge of the deliverances of that source. The case that he presents is consistent with KR, but nonetheless appears to be an instance of bootstrapping.

Weisberg's Super-Reliable Gas Gauge:
"[Mary] knows that the gauge in [her] car is reliable, and it is in fact super-reliable. On one occasion the gauge reads F, leading [her] to believe that the tank is full, which it is. [She] notes that on this occasion the tank reads F and is full. [She] then repeats this procedure many times on other occasions, coming to believe that the gauge is not only reliable, but super-reliable." [18]

It seems like the best way to think about this case is as follows. Mary knows that her gas gauge is reliable. Perhaps this was determined by a plethora of careful measurements involving a dipstick and the gas gauge. Later, she notes that the gas gauge reads "x." Because she knows that the gas gauge is reliable, she knows that the level of gas in the car is x. As a result, she knows that the gas gauge reads "x" and that the level of gas is x.[19] So she knows that the gauge was right on this occasion. Let's refer to this procedure as a bootstrappish check. Mary performs this bootstrappish

[18] Excerpted from Weisberg (2010), with name modification
[19] I assume that she knows that it in fact *read* "x"; good lighting, reliable vision, etc

check many times; in fact, she performs it enough times to come to know that the gas gauge is super-reliable.

This poses a problem for the Conservative because Mary, despite her antecedent knowledge of reliability, is apparently permitted to acquire knowledge of *super-reliability* by bootstrapping. There are two features of Weisberg's case that differentiate it from previously presented cases of bootstrapping that the Conservative could avoid. The first is that the subject has antecedent knowledge of reliability, and the second is that new knowledge is acquired as a result of this fact.

6. Clarifying what we mean by "reliable" and "super-reliable"

Intuitively, a reliable source is one that reports correctly *most of the time* or *all of the time.* It is plausible that we might refer to a source that never reports correctly, but always provides an answer within a certain specified range of the actual value, as reliable. For the sake of simplicity, I will assume that a reading is either right or wrong without any consideration of closeness to the actual value. I will therefore use the term "reliability" to describe the property of reporting correctly most of the time or all of the time.

If it is plausible that a source can be reliable without reporting correctly *all of the time,* then there is a range of values for reliability. If it is possible that one can have knowledge of reliability without being *certain* of any one degree of reliability, then there is a range of confidences in potentially various degrees of reliability. It is for this reason that quantifying confidence in reliability is essential to understanding the roles of "reliability" and "super-reliability" in Weisberg's case.

I will interpret coming to know that the gas gauge is *super-reliable* as coming to know that the gas gauge is *any more reliable* than the subject had antecedent reason to believe. Similarly, I will take evidence of super-reliability to be evidence that the gas gauge is any more reliable than the subject had antecedent reason to believe.

Bootstrapping certainly should not be able to deliver *knowledge* of super-reliability, but it also should not be able to provide any *evidence* of super-reliability *or* of mere reliability. Bootstrapping cannot provide anything of epistemic value.

It seems that Weisberg's portrayal of the "bootstrappish check" as performed many times is misleading. If we shift our focus from knowledge to evidence, Weisberg's objection can be formalized and unified with the allegedly unproblematic case involving "mere" reliability.[20]

7. Formalizing Weisberg's Case

There are infinitely many possible credence distributions that would result in any *particular* credence that any given reading will be correct, otherwise known as the conditional probability P(X | gauge reads X). I will rely heavily on the following term:

Expected Accuracy (EA): P(X | source reports X)

This is essentially the probability-weighted average of all values in the credence distribution, and is a more precise way to capture what is meant by "reliability" in the present discussion. I will use it to avoid ambiguity, and to facilitate comparison among disparate credence distributions. I will also define the following term:

Epistemic Improvement: Any increase in Expected Accuracy

I want to recognize that there are multiple ways that an epistemic improvement could take place. One could change one's epistemic attitude towards a proposition, or

[20] The case of "mere" reliability is related to White's explanation of why the Conservative does not run into a bootstrapping problem when the subject has antecedent justification for believing that her color vision is reliable. The following is an example of the case: You know that the gas gauge is reliable. You take a series of readings of the gas gauge, and know in each case that the gauge has read correctly. From these correct readings, you infer that the gauge is reliable. But, this is (allegedly) not problematic, because you *already* knew that the gauge was reliable.

one could retain the same epistemic attitude but alter the proposition that one holds it towards. For example, one could come to know that the gauge is *super-reliable*, or come to *super-know* that the gas gauge is reliable. Weisberg provides an instance of the former, but this distinction will not matter at all for the present discussion.

I will take acquiring evidence for super-reliability to be synonymous with any increase in Expected Accuracy. I think that this best preserves the spirit of Weisberg's case. Acquiring evidence that some source is *super-reliable* just means that the subject's EA value has increased from the value of the subject's antecedent EA.[21]

In order to be consistent with Weisberg's example, I want to make explicit that there are limitations on what Mary's knowledge regarding the reliability of the gas gauge can be. In Weisberg's case, the gas gauge is *in fact* super-reliable. This means that if Mary has reason to believe that the gas gauge is correct x percentage of the time, the gas gauge is in fact correct x + y, for some positive y, percentage of the time. In order to allow for knowledge of reliability to be compatible with knowledge of super-reliability, Mary must know that her gas gauge is accurate *at least* a certain percentage of the time. If she believed that it was accurate *exactly* a certain percentage of the time, then she wouldn't in fact *know* it. This is because it is super-reliable, so her belief about the exactness would be false. In the formal analog of the case, however, we need not use the construction "at least" when describing Mary's EA.[22] It is perfectly consistent for Mary to have an EA of 0.97, for instance, and then acquire evidence that causes her to raise this EA.

The following seems like a plausible principle:

---

[21] Another interpretation of "super-reliable" is that there is some threshold of reliability above which a process counts as "super-reliable," such as above 99.9 percent reliable. I think that this is a less natural interpretation of the case, but even if one prefers this interpretation, I see no consequences for my argument. I think that the way I have set up the case is the most general version and can thus account for the threshold view. One who preferred the threshold view might think that we must find out that P read correctly on many occasions and increase our EA to some high but fixed number before claiming that we have knowledge or evidence of super-reliability. I find this interpretation implausible, but think that it would not have implications for my argument as long as one accepts that coming to know that P read correctly some number of times (even if it is arbitrarily high) constitutes a reason to increase EA for P.

[22] I am disregarding the implications that "fuzzy credences" might have for this discussion.

> **KE Principle**: When you come to know that P was accurate an additional time, you acquire some evidence for the reliability of P.[23]

White denies that the Conservative picture permits a subject to acquire justification for believing that P is reliable by bootstrapping. White also denies that one who possesses antecedent justification for believing that P is reliable can bootstrap. However, upon considering the KE Principle, we might think otherwise. If one knows antecedently that P is reliable, then it seems obvious that one can come to know that P was accurate on an additional occasion.[24] According to the KE Principle, this must count as evidence for P's reliability, and is therefore reason to increase EA. This is certainly problematic, and we haven't even mentioned super-reliability yet.[25]

Weisberg implicitly relies upon a slightly different principle in his attempt to demonstrate that the Conservative is not free of the bootstrapping problem. The principle that Weisberg employs arises more naturally from the informal characterization of the case than does the KE Principle.[26] Presumably, it is a principle that the Conservative would accept as well.

> **Weisberg's New Principle**: When you come to know that P was accurate an additional time, you acquire some evidence for the *super-reliability* of P.[27]

---

[23] It would, of course, only raise EA a minuscule amount. Even if one rejects this, it does not affect what follows. As long as one accepts that there is *some* number of correct readings of P (even if it were arbitrarily high) that ought to increase our EA for P (provided that we don't already have a credence of 1), then my proposal is still relevant.

[24] I eventually claim that this principle is being mistakenly relied upon. I am here trying to motivate the results that follow from the prima facie plausibility of this misapplication.

[25] Getting evidence for something you already know is possible because there is room for epistemic improvement (as long as your credence in the known proposition is below 1).

[26] Weisberg's case is characterized "informally," meaning that it makes use of unquantified terms such as "knowledge" and "belief." I think that the KE Principle does not arise as naturally from this characterization because the thought is that if you already *knew* that P was reliable, then you cannot improve your epistemic state with respect to the proposition that P is reliable. However, when we consider a formal perspective, it is clear that one can still acquire evidence for something that one *knows*, as long as one's credence in the known proposition is below 1.

[27] It is clear that Weisberg does endorse this principle, as evidenced by footnote 6 in "The Bootstrapping Problem" (2012).

Weisberg relies upon Weisberg's New Principle as opposed to the KE Principle because his case is constructed in informal language. The Conservative can supposedly dismiss the "mere" reliability analog of Weisberg's knowledge case. This is the case in which the subject knows antecedently that P is reliable, and then, by bootstrapping, infers that P is (merely) reliable. Because no knowledge is gained, this is not thought to be problematic. Conservatives cannot analogously dismiss the super-reliability case, because new knowledge is gained.

However, when we look at the formal versions of each, both seem problematic. As a result, the formal perspective is asymmetric with the informal perspective. The asymmetry exists because of the "mere" reliability case. If we antecedently know of P's reliability and then perform a bootstrappish check, we might *infer* that P is reliable, but we do not gain *knowledge* that P is reliable.[28] However, we do seem to have a bootstrapping problem when we acquire evidence for the reliability of P, even if we knew antecedently that P was reliable. This is true because even if we know antecedently that P is reliable, acquiring additional evidence for the reliability of P is still possible, and seems like reason to increase our EA for P. [29] Increasing EA is a substantial epistemic gain that bootstrapping should not be able to provide.

When looked at from a formal perspective, it becomes clear that KE Principle and Weisberg's New Principle are actually the same principle. The essence of both is that you ought to raise your EA when you come to know that P got one right. From this point forward I will refer to the principle as:

> **EA Principle**: When you come to know that P was accurate an additional time, you should raise your Expected Accuracy for P.

8. Revisiting White's Case

[28] Since in order to gain knowledge the subject must come to know something that she did not know antecedently.

[29] It's still possible as long as the EA is below 1.

White indicates that if one antecedently knows that P is reliable, then there is no concern about acquiring evidence that enables one to come to know that P is reliable, since one knew it beforehand.[30] Weisberg's observation is that Epistemic Improvements are still possible, even if you antecedently know that P is reliable. The consequence of this is that even the Conservative can achieve an Epistemic Improvement via the bootstrapping procedure. If this is right, then it seems that every view is susceptible to the bootstrapping objection, with the exception of the infallibilist. The infallibilist avoids the problem because the infallibilist maintains that one must have certainty to have knowledge, meaning that there will never be the room for Epistemic Improvement that bootstrapping requires.[31]

White focuses on cases in which one does not have antecedent reason to believe that one's color vision is reliable. He mentions that cases in which the subject *does* have antecedent justification for No Errors are unproblematic with respect to bootstrapping, because the subject does not undergo an Epistemic Improvement; after all, she was *already* justified in believing (or knew) No Errors.

In Weisberg's case, the subject *knows* that the source in question is reliable. So it seems reasonable to suppose that she is justified in believing Low Errors. If she is to come to be justified in believing a Track Record proposition, she must *also* be justified in believing No Errors.[32] However, justification for or knowledge of No Errors does not preclude Epistemic Improvements with respect to reliability.[33] After all, she could have a high but sub-1 credence in No Errors. This leaves the necessary room for Epistemic Improvement.

Suppose that you know No Errors and have a credence of 0.99 in No Errors.[34] You view a series of colored cards. You now know a Track Record proposition, and have a correspondingly high credence in it. By the Closure Principle for Knowledge, you

---

[30] White states this in terms of justification, but the same reasoning seems applicable to knowledge.

[31] Infalibilism is largely counterintuitive, and so it would be preferable to avoid having to accept it.

[32] Since No Errors is entailed by Track Record, the subject must be as confident in No Errors as she is in Track Record.

[33] She could have .99 confidence in No Errors and still acquire reason to raise this confidence, for example

[34] Or any arbitrarily high credence, as long as it is below 1.

can infer No Errors, and have a correspondingly high credence in that. According to White, this is not problematic, because you *already* knew No Errors. But, it looks like you have room to increase your confidence in No Errors, so why should we think that this case is any different from Weisberg's super-reliable gas gauge case? It seems like coming to know that one has gotten an additional card reading correct is reason both to increase one's EA for one's color vision and to increase one's confidence in No Errors. It therefore appears that the fact that one was already justified in believing or already knew No Errors is not necessarily protection against bootstrapping.

9. Blocking Bootstrapping:

I argue that the way to prevent bootstrapping is to block bootstrapping from providing any reason to raise one's Expected Accuracy. I will suggest two initially plausible principles that impose stricter conditions on what it takes to raise one's Expected Accuracy. I will ultimately reject these possible solutions, but it is useful to see how they might be initially compelling. I will settle on a third solution, which I will discuss last.

10. No Lateral Pulling Solution

Consider the following example. Mary knows that her gas gauge is reliable, and has an EA of 0.97 for the gauge. In fact, it is even more reliable than Mary has reason to believe. Specifically, it happens to be 100 percent reliable. Mary knows that Sally is reliable, and has an EA of 0.97 for Sally. Sally tells Mary that the gas gauge got another reading correct. Should Mary now increase her EA for the gas gauge? It seems like it might be reasonable to say no; after all, Mary's EA for Sally is only 0.97, which is exactly the same as Mary's EA for the gas gauge.

If this is right, then it seems that we ought to treat the reading of a gas gauge for which Mary's EA is some value C in exactly the same way. Even if Mary knows that her gas gauge is reliable, and has an EA of 0.97 for the gauge, she cannot use additional

readings of the gas gauge as evidence for its super-reliability, because Mary's EA for the gas gauge is, of course, self-identical.[35]

Now let's consider the following case. Mary still has an EA of 0.97 for the gas gauge. But, this time, Mary has an EA of 0.99 for Sally. Sally reports that the gas gauge just read correctly. Should Mary increase her EA for the gas gauge this time? It seems that she should, because Mary's EA for Sally is higher than Mary's EA for the gas gauge.

In order to account for the difference between these two cases, I will propose the following principle:

> **No Lateral Pulling**: To increase one's Expected Accuracy for some process P, one's credence that P read correctly (on this new occasion) must exceed one's Expected Accuracy for P.

This might seems like a plausible principle at first, and it certainly prevents bootstrapping. But, this principle is in conflict with Bayesianism.

If you start with a credence of 0.9 that test T is 80 percent reliable and a credence of 0.1 that T is 90 percent reliable, your EA for T is 0.81. Suppose that you have an EA for Mary of 0.81 as well. If Mary tells you that T just got one right, conditionalizing on the evidence will result in a new EA for T of approximately 0.810806125.[36] If she continues to report correct readings of T, your EA for T will eventually approach 0.9. This is a clear violation of No Lateral Pulling, so this principle is inconsistent with Bayesianism.

11. Upper Limit Solution

[35] Mary cannot use additional readings as evidence of mere-reliability either, because (as I argued before) they are formally the same.

[36] Since $P(A|B) = \frac{P(A)P(B|A)}{P(A)P(B|A)+P(\neg A)P(B|\neg A)}$

$$P(T\ is\ 80\%\ reliable|E) = \frac{0.9((0.8)(0.81)+(0.2)(0.19))}{0.9((0.8)(0.81)+(0.2)(0.19))+(0.1)((0.9)(0.81)+(0.1)(0.19))} \approx 0.89193875$$

$$P(T\ is\ 90\%\ reliable|E) = \frac{(0.1)((0.9)(0.81)+(0.1)(0.19))}{(0.1)\big((0.9)(0.81)+(0.1)(0.19)\big)+(0.9)((0.8)(0.81)+(0.2)(0.19))} \approx 0.10806125$$

$$\mathrm{EA_{new}} = (0.9)(0.10806125) + (0.8)(0.89193875) \approx 0.81080613 > \mathrm{EA_{Mary}} = 0.81$$

The intuitions motivating No Lateral Pulling can be used to formulate a principle that I think has even more prima facie plausibility. It is useful to see how this principle might work.

The general idea is that if some source M is one's only source of information about the reliability of some target source P, then one's Expected Accuracy for M puts an upper limit on one's possible Expected Accuracy for P.

Suppose that I have an EA of 0.92 for my telescope. I have no information as to whether or not a given theory, T, is correct. Using only the telescope, I make a series of observations and compare my observations with the predictions of T. It seems as though my confidence in the reliability of T ought to be capped by my EA for the telescope. After all, I only have a credence of 0.92 that anything I observe through the telescope actually obtains. Even if my observations perfectly match the predictions of the theory, it does not seem that I should ever come to have an EA of greater than 0.92 for T. Any errors that the telescope introduces will correspond to errors in my judgment of T's accuracy.

Alternatively, suppose that Sally has no idea whether or not a test for disease X is reliable. If we accept that having no information one way or the other ought to give Sally an EA of 0.5, then Sally has an EA of 0.5 for the test.[37] Now, suppose that Sally has an EA for Mary of 0.6. Mary reports to Sally that the test just got one right. On a Bayesian picture, this is some evidence for the reliability of the test, because conditionalizing on the evidence results in Sally having a higher EA for the test than she had before. We might think that while this is perfectly acceptable, it would be rather counterintuitive for Sally's EA for the test for disease X to ever exceed Sally's Expected Accuracy for Mary, as long as Mary remains Sally's only source of information about the test. It might seem strange if Sally could come to have an Expected Accuracy in the test of 0.61, for example, if her Expected Accuracy for Mary is only 0.6.

[37] According to the Indifference Principle, if you have no information as to whether *p*, you should have a credence of 0.5 that *p.*

As a result, I will suggest the following principle:

> **Upper Limit:** In cases in which some source *S* is one's only source of information about the reliability of some target source *P,* one's Expected Accuracy for *S* puts an upper limit on one's possible Expected Accuracy for *P.*

Bootstrapping is a special case because one's only source of information about the reliability of some process P is the process P itself. So one's EA for P puts an upper limit on what one's EA for P can be. Of course, this means that one cannot increase one's EA for P by bootstrapping, which is the desired result. This is a principle that blocks all instances of bootstrapping, but does not prevent all "Lateral Pulling," which is a much more desirable result.

Using this principle, if one comes to know that P got an additional reading correct (by using only P as a source), one cannot count this as evidence for P's super-reliability, because it cannot be reason to increase one's Expected Accuracy.

However, Upper Limit is an instance of a more general principle. This more general principle is in conflict with Bayesianism.

> **Upper Limit (Generalized):** In cases in which some source *S* is one's only source of information about some proposition *p,* one's Expected Accuracy for *S* puts an upper limit on one's possible confidence in *p.*

Suppose that I want to figure out whether the temperature in the room, which remains constant, is odd or even on the Fahrenheit scale when rounded to the nearest integer. I have a special thermometer that reports only "odd" or "even." My Expected Accuracy for the thermometer is 0.8. My initial credence that the temperature is odd is 0.5, and my initial credence that the temperature is even is also 0.5, since I know that these are the only two possibilities, but have no information as to which it is. I take a reading of the thermometer, and it says "odd." After conditionalizing on this evidence, my new credence that the temperature is odd will be 0.8, while my new credence that the temperature is even will be 0.2.[38] If I take one more reading of the special thermometer,

[38] $P(odd|E) = \frac{(0.5)(0.8)}{(0.5)(0.8)+(0.5)(0.2)} = 0.8$

and it says "odd," then conditionalizing will result in my having a credence of approximately 0.94 that the temperature is odd.[39] This is a clear violation of the generalized form of Upper Limit, since my credence that the temperature is odd exceeded my EA for the thermometer.[40]

12. Does the Bayesian Have a Bootstrapping Problem?

Consider the following two cases:

Acceptable: Mary, who you have an Expected Accuracy for of 0.98, tells you that that P just got one right. So you have a credence of 0.98 that P just got one right.

Bootstrapping: You have an Expected Accuracy of 0.98 for P, and observe that P says "x." So you have a credence of 0.98 in x, and therefore a credence of 0.98 that P just got one right.

At first, it might look like even with Bayesian conditionalization, the two cases above equally facilitate an increase in your Expected Accuracy for P. After all, in both cases you end up with a credence of 0.98 that P got another reading correct.

This is not right, however. There is an important distinction between these two cases. On the Bayesian picture, one must conditionalize on the strongest piece of evidence that one finds out. In the Acceptable case above, this is that Mary, for whom you have an Expected Accuracy of 0.98, reported that P read correctly. This is much more likely to occur if P *actually* read correctly. In the Bootstrapping case above, your strongest piece of evidence is that P reads "x." However, P's reading "x" is completely independent of any hypothesis about P's reliability. P is not more likely to report "x" if P is reliable, and P is not less likely to report "x" if P is reliable. So you can raise your Expected Accuracy in the Acceptable case, but not in the Bootstrapping case.

It looks like the intuitions motivating No Lateral Pulling and Upper Limit can be accommodated in a Bayesian solution. That is, the Bayesian machinery prevents

[39] $P(odd|E') = \frac{(0.8)(0.8)}{(0.8)(0.8)+(0.2)(0.2)} = \frac{64}{68} \approx 0.9412$

[40] It remains to be seen whether or not some restricted version of the principle in which the probability is distributed over infinitely many propositions is in conflict with Bayesianism. The answer to this question is of little consequence to this paper, since the solution that I eventually propose does not hinge on the truth or falsity of Upper Limit.

bootstrapping from providing any reason to increase Expected Accuracy. Because the Bayesian has a principled way of distinguishing between the Acceptable case and the Bootstrapping case, it seems like the Conservative can employ this strategy[41] and claim that an additional viewing of a colored card (or an additional reading of a gas gauge) is not any reason to increase one's Expected Accuracy, even if one knows antecedently that one's color vision or the gas gauge is reliable. This means that the Bayesian must either reject the Expected Accuracy Principle, or claim that it was not deployed correctly in Weisberg's case. In the next section I will consider both options.

13. Are Bayesianism and Informal Epistemology Incompatible?

By "informal," I mean those approaches to epistemology that make use of unquantified terms like "belief," "justification," and "knowledge." The potential point of conflict between the Bayesian view of evidence and informal views that rely upon "knowledge" and "justification" is the rejection of the EA Principle. It might seem counterintuitive for an informalist to claim that despite *coming to know* that P read correctly, this is not any *evidence* that P is reliable. Perhaps it is too ad hoc to insist on this particular distinction between knowledge and evidence for the purpose of avoiding bootstrapping.

There are two options. The first is that informalists will simply have to accept that there are some cases in which one comes to be justified in believing or comes to know that P got an additional reading correct, but that this is not any reason to increase one's Expected Accuracy for P.[42]

The second option is much more plausible. Rather than rejecting the EA Principle, the informalist can claim that the EA Principle is simply inapplicable to Weisberg's case, because the subject did not really *come to know* that the gas gauge got an additional reading correct. After all, the subject knew antecedently that she would judge any given reading of the gas gauge to be correct. A subject can come to know

[41] And must do so in order to be Bayesian.

[42] There are such cases. For example, if an omniscient being tells you that the gas gauge is exactly 83 percent reliable, then finding out that the gauge got one more reading correct will not be any reason to update your EA for the gas gauge.

only some information that the subject did not know antecedently. The subject *did* come to know that the gauge read "x," because she did not know antecedently what particular reading the gas gauge would give. This is true because reliability of the gauge does not entail that any given level of gas (and therefore any given reading) will obtain. As a result, she did not know this piece of information in advance, and can conditionalize on it as new evidence. But, as discussed before, conditionalizing on the fact that the gauge read "x" will not be any reason to update one's credence in any hypothesis about the degree of reliability, so bootstrapping is avoided.

As a result, it seems like the right answer in this case is that the Conservative ought to accept the EA principle, but claim that the principle was misused in Weisberg's example. Weisberg's case depends fundamentally on the relationship between "coming to know" that P read correctly and the getting of evidence for super-reliability. However, because the subject in Weisberg's case does not genuinely come to know that the gas gauge read correctly, this is not any evidence for super-reliability, and thus not any reason to increase EA. This coincides nicely with the Bayesian picture of evidence. The Conservative can therefore preserve the use of informal epistemology while simultaneously adhering to Bayesian principles of evidence. The result is that Weisberg's case is founded upon the mistaken use of an otherwise plausible principle, and involves the violation of the Bayesian picture of evidence. The Conservative who accepts Bayesianism is therefore guaranteed to avoid any apparent threat of bootstrapping introduced by Weisberg's example.

14. Bayesian Formalists Never Bootstrap

If one is a Bayesian and rejects informal language completely, then one will never run into a bootstrapping problem. If we reconstruct Weisberg's case in formal terms, there is no possibility of bootstrapping.

The Bayesian Formalist's Gas Gauge

> Mary has some credence distribution that results in an EA of 0.99 for her gas gauge. She reads the gas gauge, and it says "x." So she has a credence of 0.99 that x is the level of gas in the car. So, she has a credence of 0.99 that P just read correctly. Because the gas gauge was no more or less likely to report "x" if it were reliable, Mary does not increase her EA for her gas gauge.

However, as discussed above, I think that certain informal views can employ the Bayesian picture of evidence to avoid bootstrapping. The following is an example of how this would work for the Conservative.

> **The Bayesian Conservative's Gas gauge**
> Mary knows that her gas gauge is reliable. She reads the gas gauge, and it says "x." So, she knows that x is the level of gas in the car. So, she knows that P just read correctly. She performs this procedure an arbitrarily high number of times, and knows in each case that P has read correctly. Because the gas gauge was no more or less likely to report "x" if it were reliable, Mary is not able to come to know that her gas gauge is super-reliable, nor is she able to acquire any evidence for the super-reliability of her gas gauge in this way. Though she knows[43] in each case that the gas gauge has read correctly, this provides her with no evidence, and thus no knowledge, of super-reliability.

It seems as though what White identified as a problem for dogmatism is in fact a problem for informalists who fail to abide by a Bayesian picture of evidence. Dogmatism is a special case because it is a view that is inconsistent with Bayesianism, and so cannot elect to adopt a Bayesian picture of evidence. On the other hand, the Conservative can do so in a perfectly coherent and principled way. As a result, I am pinning the Conservative's apparent problem of bootstrapping on Weisberg's failure to abide by Bayesian principles in his example.

15. Conclusion

If the Conservative adopts the Bayesian view of evidence, then bootstrapping can be avoided. Weisberg's example is predicated on the misuse of a principle that is

[43] She knows it but did not *come to know* it.

otherwise plausible, and therefore his example of the super-reliable gas gauge does not accurately represent the epistemic commitments of the Bayesian Conservative. If the Conservative abides by the Bayesian picture of evidence, then it seems like Weisberg's example does not have the force that it originally seemed to, and that White's defense still stands.

REFERENCES

Cohen, Stewart. (2002). Basic Knowledge and the Problem of Easy Knowledge. *Philosophy and Phenomenological Research* 65(2), 309 – 329.

Cohen, Stewart. (2005). Why Basic Knowledge is Easy Knowledge. *Philosophy and Phenomenological Research* 70(2), 417 – 430.

Fumerton, Richard. (1995). *Metaepistemology and Skepticism*. Rowman & Littlefield.

Howson, Colin and Peter Urbach. (1996). *Scientific Reasoning: The Bayesian Approach*. Open Court.

Kornblith, Hilary. (2009). A Reliabilist Solution to The Problem of Promiscuous Bootstrapping. *Analysis* 69(2), 263 – 7.

Pryor, James. (2000). The Skeptic and the Dogmatist. *Noûs* 34(4), 517 – 549.

Titlebaum, Michael. (2010). Tell Me You Love Me: Bootstrapping, Externalism, and No-Lose Epistemology. *Philosophical Studies* 149(1), 119 – 34.

Vogel, Jonathan. (2000). Reliablism Leveled. *Journal of Philosophy* 97(11), 602 – 23.

Vogel, Jonathan. (2008). Epistemic Bootstrapping. *Journal of Philosophy* 105(9), 518 – 539.

Weisberg, Jonathan. (2010). Bootstrapping in General. *Philosophy and Phenomenological Research* 81(3), 525 – 48.

Weisberg, Jonathan. (2012). The Bootstrapping Problem. *Philosophy Compass* 7(9), 597 – 610.

White, Roger. (2006). Problems for Dogmatism. *Philosophical Studies* 131(3), 525 – 57.